

# Description

## Parking Brake Lock

### BACKGROUND OF INVENTION

[0001] This invention relates to a locking mechanism to retains a clamping force that holds first and second friction members into engagement with a rotor to sustain a park brake application.

[0002] It was common for vehicles to have disc brakes on the front wheels and drum brakes on the rear wheels; however, currently it is common to have disc brakes on all four wheels. This requires a revision to the parking brake structure in the absence of drum brakes. A common type of park brake used with rear calipers are drum-in-hat brakes is disclosed in U.S. Pat. No. 5,180,037, integral piston brakes disclosed in U.S. Pat. No 5,038,895 or a separate brake as disclosed in U.S. Pat. No. 5,921,354. All of these types of brakes require an input force from an operator applied through a lever to mechanically move friction members into engagement with a rotor or drum associated with a wheel to effect a parking brake applica-

tion. Theoretically hydraulic pressure could be used to engage friction members with a rotor or drum, but hydraulic systems can leak and as a result of such a leak the clamping force may be released thereafter allowing the vehicle to move on an inclined surface. In addition, federal regulations do not allow purely hydraulic means for holding park brake applications and require a mechanical means to hold park brake applications and thereby lock the wheels. While the current federal regulations do not prohibit using hydraulic pressure to effect a parking brake application a mechanical backup must be provided for sustaining parking.

#### **SUMMARY OF INVENTION**

[0003] A primary purpose of the present invention is to provide a mechanical means to hold a park brake in an applied position after hydraulic pressure was used to initiate the park brake apply even after hydraulic pressure is removed.

[0004] The disc brake according to the present invention has a support member secured to a vehicle. The support member has first and second guides to align a caliper over a rotor associated with a wheel of a vehicle. The caliper has an actuation section connected by a bridge to an arm. The

actuation section has a bore therein for retaining a piston to define an actuation chamber. A first friction member is connected to the arm on one side of the rotor and a second friction member is connected to the piston on the other side of the rotor so that the two friction members are aligned with each other on opposite sides of the rotor. The piston is prevented from rotating with respect to the second friction member by anti rotation members engaged with the piston. Pressurized fluid is presented to the actuation chamber which acts on the piston to develop a dynamic clamping force that urges the first and second friction members into engagement with the rotor to effect a brake application. The pressurized fluid has a predetermined pressure, which is sufficient to generate enough clamping force to lock the rotors associated with the wheels of a vehicle when the vehicle is on an incline.

[0005] An advantage of the disc brake provided by the present invention resides in the ability to maintain a static clamp force to engage friction members with a rotor in the absence of pressurized fluid.

[0006] A further advantage of the present invention resides in a locking mechanism that conforms to current federal parking brake regulations since it does not depend on hy-

draulic pressure to maintain a park brake apply.

## **BRIEF DESCRIPTION OF DRAWINGS**

- [0007] Figure 1 is a schematic illustration of a disc brake made according to the present invention;
- [0008] Figure 2 is a sectional view taken along line 2-2 of Figure 1;
- [0009] Figure 3 is a sectional view of the disc brake in Figure 1 with a piston in an actuated position; and
- [0010] Figure 4 is a sectional view of locking means that holds the piston in the actuated position to effect a parking brake application.

## **DETAILED DESCRIPTION**

- [0011] The disc brake *10* as shown in *FIGS. 1 and 3* is utilized as a service brake and a parking brake in a vehicle and includes a locking mechanism *11* of the present invention. The locking mechanism *11* holds a first friction member *12* and a second friction member *13* into engagement with a rotor *14* during a park brake application.
- [0012] The disc brake *10* has a housing that includes an actuation section *15* connected by a bridge *16* to an arm *17*. The actuation section *15* has a bore *18* therein with a piston *19* to define an actuation chamber *20*. The actuation chamber *20*

also retains a locking mechanism 11. The first friction member 12 is connected to the arm 17 while the second friction member 13 is connected to piston 19 so that the first 12 and second 13 friction members are aligned on opposite sides of the rotor 14. The rotor 14 rotates with the wheel of a vehicle. During a brake application pressurized fluid is introduced into the actuation chamber 20 to exert a force on the piston 19. The force exerted on the piston 19 moves the second friction member 13 into engagement with the rotor 14 and the force is transmitted through the bridge 16 to the arm 17 which pulls the first friction member 12 into engagement with the rotor 14 to generate a clamping force. The clamping force can be selectively established by changing the pressure in fluid introduced into the actuation chamber 20 to effect a service brake apply for stopping a vehicle or maintained by the locking mechanism to affect a park brake apply.

[0013] The locking mechanism 11 is located within the actuation chamber and defined by a first threaded member 21 that is integrally attached to piston 19, a second threaded member 23 that rotates on first threaded member 21 by threads that mate with the first threaded member 21, and a bearing section 36. The bearing section 36 includes a

snap ring 24 that is retained in a groove 25 in bore 18 wherein a preloaded wave washer 26 exerts against snap ring 24 and bearing washer 27. The bearing washer is urged against a first thrust bearing 28. The first thrust bearing 28 presses against a first surface 29 on the second threaded member 23 to urge a second surface 30 thereon against a second thrust bearing 31 positioned at the bottom of bore 18. The second threaded member 23 is able to rotate on the first threaded member 21 and has no lash threads that mate with the first threaded member 21. The first threaded member 21 moves forward with the piston 19 while the second threaded member 23 is restrained from moving forward. This restraint allows the second threaded member 23 to rotate within the actuation chamber 20. The first threaded member 21 is limited to linear movement as it is prevented from rotating with respect to the bore 18 by anti rotation members 22 (raised buttons on the backing plate) on the second friction member 13. The locking mechanism 11, as shown in Figure 2, further includes a plunger 32 that is moved by a solenoid 36 to bring teeth 33 on the plunger 32 into engagement with teeth 34 on the second threaded member 23 when a park brake application is desired. The solenoid 36 could be re-

placed with a shaft that is moved by a manual input to bring teeth 33 into engagement with teeth 34 to define the locking position.

## MODE OF OPERATION

[0014] When a vehicle is moving the disc brake 10 is in off brake position as illustrated in Figure 1, with the first 12 and second 13 friction members are separated from the rotor 14 by a small distance. When an operator of a vehicle that includes a disc brake 10 desires to stop the vehicle, an input force is applied to a brake pedal and a control valve is actuated to supply hydraulic fluid from a remote source to the actuation chamber 20. The pressurized hydraulic fluid in the actuation chamber 20 acts on piston 19 to exert a separation force, that extends the piston toward the rotor 14 to engage the second friction member 13 with a first face 14a of the rotor 14. After second friction member 13 has contacted the first face 14a of the rotor 14 the force is transmitted through the bridge 16 to the arm 17 which pulls the first friction member 12 into contact with a second face 14b of the rotor 14. As the first 12 and second 13 friction members move to close the gaps  $X1$  and  $X2$  with the rotor the piston extends from the bore 18 a distance equal to the sum of  $X1$  and  $X2$  to fully extend the piston in

a brake apply as illustrated in Figure 3. As piston 19 moves to the fully extended position, a first threaded member 21 which is integrally attached to piston 19 also advances with the piston 19 in bore 18. The piston 19 and first threaded member 21 are prevented from rotating with respect to the second friction member 13 by the engagement of anti rotation members 22 with piston notches 60. The second threaded member 23 is able to rotate on first threaded member 21 and has no lash threads that mate with first threaded member 21. As first threaded member 21 moves forward with piston 19, the second threaded member 23 is restrained from moving forward which causes the second threaded member 23 to rotate. A brake application may be sustained by the locking mechanism 11 to effect a parking brake application. With the fluid pressure in chamber 20 and the piston 19 extended, a signal is provided to solenoid 36 to move plunger 32 and bring teeth 33 into engagement with teeth 34, as shown in FIG 4. When teeth 33 are engaged with teeth 34 on the second threaded member 23 rotation is prevented, which prevents linear movement of first threaded member 21, which is integrally connected to piston 19 and prevents return movement of the piston from the extended posi-



tion shown in *FIG. 3* to the rest position of *FIG. 1*. Since the second threaded member 23 is prevented from rotating due to engagement with the plunger 32 pressurized fluid in chamber is no longer necessary to hold the extended position as shown in *FIG. 3*. Thus it is possible that the fluid pressure in chamber 20 may be eliminated and the clamping force is sustained until released by the operator. To release the parking brake application the operator introduces high pressure fluid to chamber 20 which acts on piston 19 and the teeth 33 are thereafter retracted from engagement and allows return of the piston to the rest position of *FIG. 1* and release of the friction members from engagement as seen in *FIG. 1*.